Electrical Engineering Department

Prelab7

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Date:12/10/2018

Part A: Impedance Measurement

1. For the circuits shown in Figures 7.7 - 7.10 calculate the magnitude of the impedances ZR, ZC, ZL, and ZRC respectively, for the following frequencies: 250, 500, 1000 and 2000 Hz.

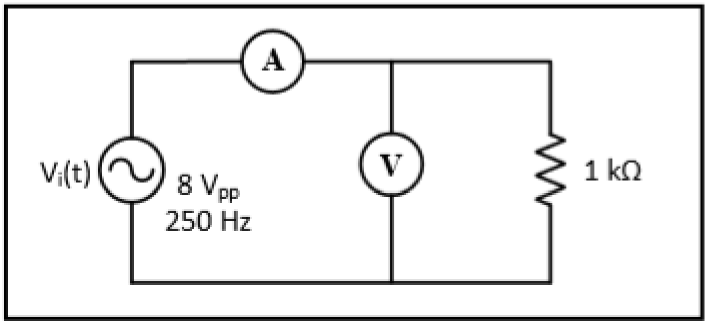


Figure 7.7

Z_R = 1kΩ   at any frequency(constant)

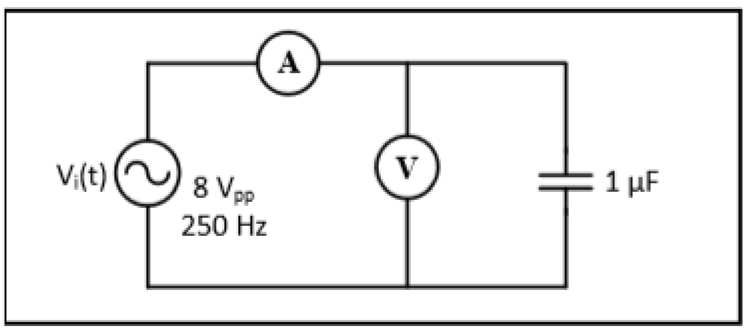


Figure 7.8

$Z_c = 1/wc = 1/(250 *2*\pi *1*10^{-6}) = 636.6\ \Omega$ f = 250 Hz

$Z_c = 1/(500*2*\pi*10^{-6}) = 318.3\ \Omega$ f=500 Hz

$Z_c = 1/(1000*2*\pi*10^{-6}) = 159.2\ \Omega$ f=1000 Hz

$Z_c = 1/(2000*2*\pi*10^{-6}) = 79.6\ \Omega$ f=2000 Hz

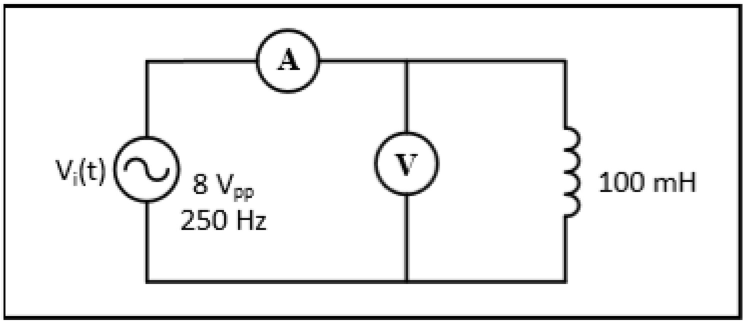


Figure 7.9

Z_L = w*L = 2*π*250 *0.1 = 157 Ω f=250 Hz

Z_L = w*L = 2*π*500*0.1 = 314Ω f=500 Hz

Z_L = w*L = 2*π*1000 *0.1 = 628 Ω f=1000 Hz

Z_L = w*L = 2*π*2000 *0.1 = 1256 Ω f=2000 Hz

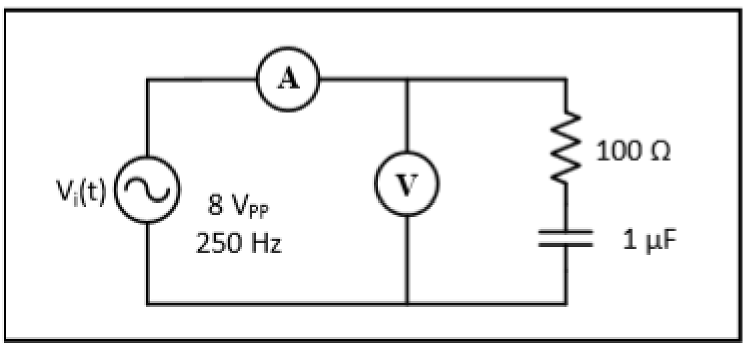


Figure 7.10

Z_R =100 Ω (do not be affected by frequency)

$Z_{RC} = \sqrt{(Z_R^2 + Z_C^2)}$

$Z_{RC} = \sqrt{(100^2 + 636.6^2)} = 644\ \Omega$ f=250Hz

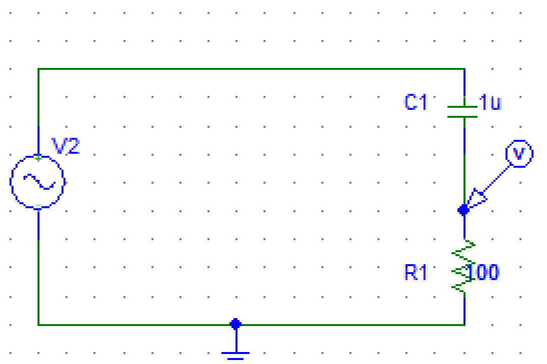
$Z_{RC} = \sqrt{(100^2 + 318.3^2)} = 333.6\ \Omega$ f=500Hz

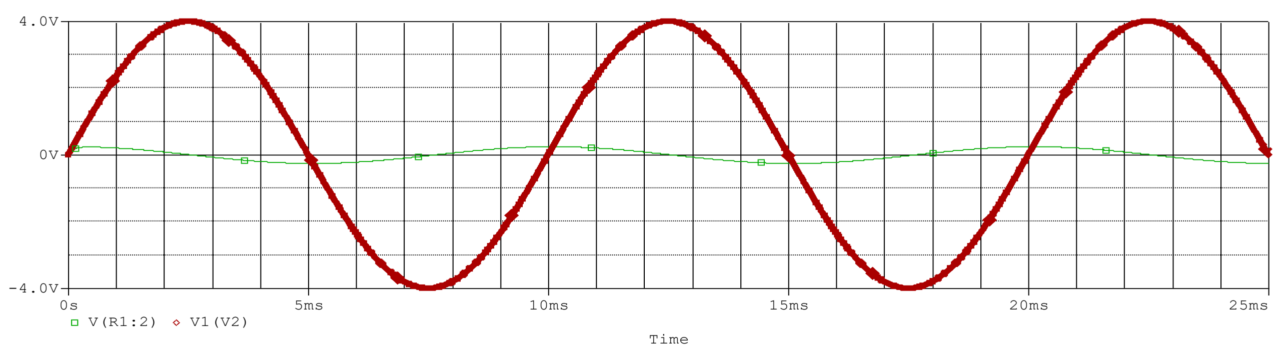
$Z_{RC} = \sqrt{(100^2 + 159.1^2)} = 188\Omega$ f=1000Hz

$Z_{RC} = \sqrt{(100^2 + 79.5^2)} = 127\ \Omega$ f=2000Hz

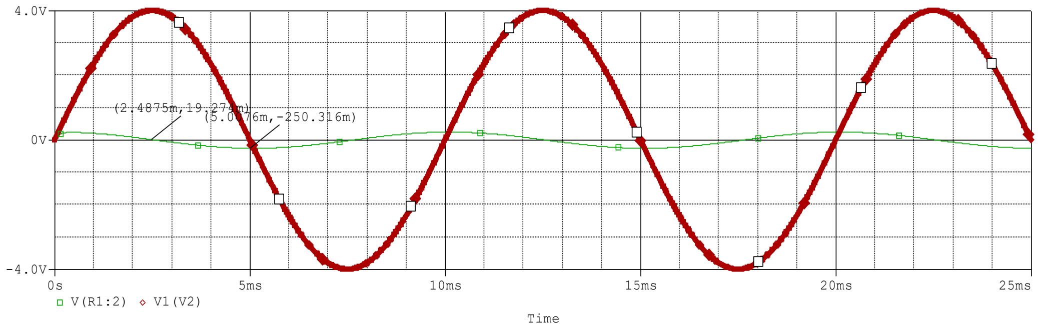
Part B: Phase Measurement

1. For the circuit shown in Figure 7.11
   a. Use PSPICE to do transient analysis of the circuit, show Vin(t) and VR(t) on one plot





b. Use cursors to measure the time difference between the peaks of the two signals, then use the following relationship to calculate the phase shift using the measured time {$\Delta\theta = \mathbf{360° \; x \; f \; x \; \Delta t}$}.



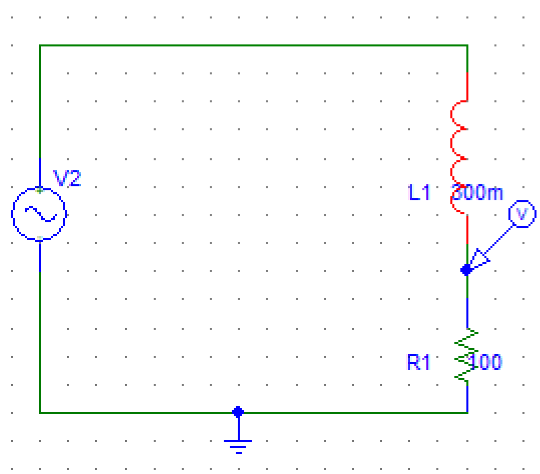
From the figure above

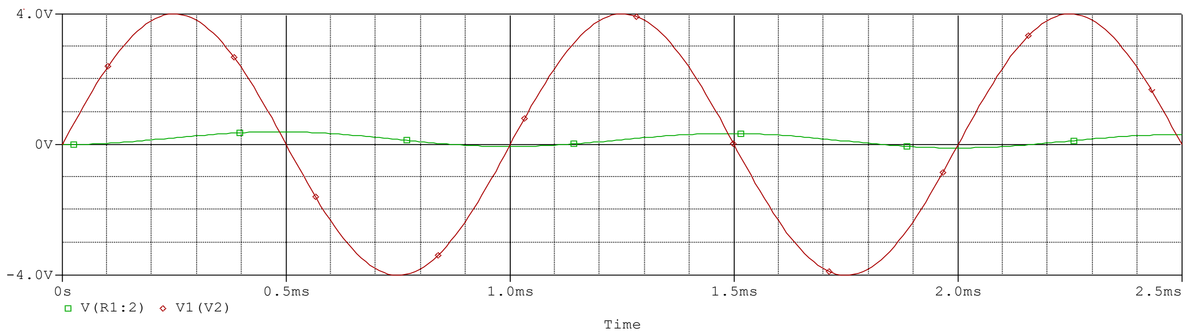
$\Delta t = (5-7.5)ms = -2.5ms$

$\Delta\theta = 360 * f * \Delta t = 360 * 100 * 2.5 * 10^{-3} = -90^{\circ}$

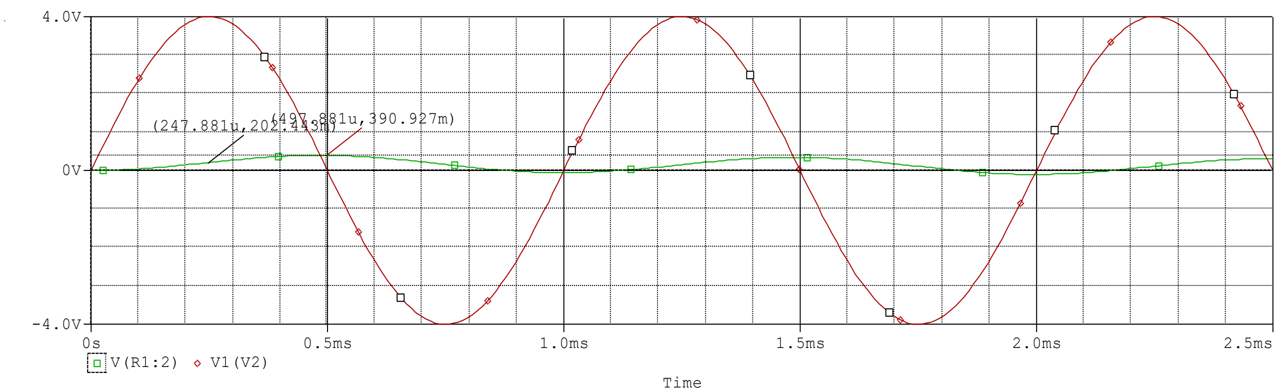
Repeat the same procedure in step 1 above for the circuit shown in Figure 7.12

a. Use PSPICE to do transient analysis of the circuit, show Vin(t) and VR(t) on one plot





b. Use cursors to measure the time difference between the peaks of the two signals, then use the following relationship to calculate the phase shift using the measured time {$\Delta\theta = 360° \times f \times \Delta t$}.



From the figure above

$\Delta t = (0.5-0.25)ms = 0.25ms$

$\Delta\theta = 360 * f * \Delta t = 360 * 1000 * 0.25 * 10^{-3} = 90°$